To Design or To Draw: Two different verbs, two different abilities, one result

Valeria Carnevale, University of Derby, U.K.

The essay aims to put forward an etymological and neurological difference between 'designing' and 'drawing'. Taking into account the theory of the left and right side of the brain, it explains how 'to design' and 'to draw' belong to different abilities. This difference is crucial to the understanding of space and form; geometry. The essay considers the use of hand drawing and physical model making as crucial to comprehend the essence of design. Technical drawing however is a mathematical procedure thus can be done without the understanding of how to design. It will follow to explain the importance of the design process as a hand drawn/modelled tool in the first years of a design related degree. It will also challenge quick and easy CAD programmes like Sketch-up.

Finally, the essay will try to compare the ideas of other scholars in the fields of design, art and architecture with our own experience. Whereas keeping to the premises of a pedagogical approach of learning by doing, in which cognitive and personal learning is expected and enhanced (Lyon, 2011), theoretical and critical understanding will balance the relation of both: the creative and the rational; 'to design' and 'to draw'.

Keywords: Cognitive process, sketching, design process.

Section Heading

Drawing skills have been, for centuries, a fundamental requirement to anyone attempting to study and practice the fields of architecture and design. A designer or architect will represent his/her ideas through drawings; this is how they communicate thus something that is not only an intrinsic requirement but also, will never cease to exist. Throughout the ages the drawing mediums have changed and evolved, slow at first then escalating as the 21st century approached and finally boosting into computer drawings in the last decade or so. Strictly speaking hand drawings or computer drawings will create the same result but it is the aim of this paper to explain why these two ways of drawing differ. It will aim to explain the importance of hand drawings during the development process of a design student and how drawing and designing defer from each other. This is an important differentiation because the process of *designing* and the skill to *draw* can be thought as one or similar but in fact they are in essence, contrasting.

> …the seductive 'coolness' of digital media fascinates architects and clients and architectural students –paradoxically even before they are enrolled. Many are won over by the striking otherworldliness of digital imaging, while others are swayed by the notion that using digital representations will expedite the conceiving of buildings… (Frascari, 2011).

From the point of view of a student, computer programmes can be the solution to the inability to draw or make physical models rather than just a medium to speed a process. Such students start a design or architecture course with the thought that computers will do the work for them and that there is no need to have the skill to draw. This is an erred conception which this paper will try to demystify. The intention of the study is to critically analyse other writers' point of view on the matter or on related subjects thus demonstrating that the introduction of 'easy to use' computer drawing programmes in young architecture students does not help the learning process and is actually affecting the way they understand space and 3D form. Worse it is overtaking the analysis of the design process. It is drawing without design, more importantly without the creative thinking. Bruce Mau describes the importance of the process as follow: 'Process is more important than the outcome when outcome drives the process we will only ever go to where we've already been. If the process drives the outcome we may not know where we are going, but we will know we want to go there' (Marks 2011, 47).

The paper will try to put forward in the first chapter the notion that a neurological difference exists between 'designing' and 'drawing'. By taking into account the theory of left and right side of the brain and its functions, demonstrate how each concept relates to a different side or ability and finally, that one cannot exist without the other in terms of good design.

The paper then proceeds, in the second chapter, to identify the benefits of hand drawing and computer drawing programmes. How they have evolved, the different types of representation techniques and types of CAD programmes. It will finish by aiming to compare and contrast digital representation, orthographic drawing, hand drawing and model making. Finally, it will try to compare the ideas of other scholars in the fields of design, art and architecture with our own findings and experience. Through the ideas expressed in the two chapters, the paper will put forward the concern and a proposal for design teaching in the first year of architecture and design courses. Whereas keeping to the premises of a pedagogical approach of learning by doing in which cognitive and personal learning is expected and enhanced (Lyon 2011, 107) but theoretical and critical understanding will balance the relation of both, the creative and the rational. The use of students' work will be used to emphasise the ideas that brought forward the need to write this paper.

Chapter 1

The Brain left and right lobes

In order to understand the reasoning behind this paper it is important to state the difference between the ability to create a space or 3D body –*design*, and the skill to represent an existing form –*draw* (Ching and Juroszek 1997). This first sentence is important because if read carefully it distinguishes a clear difference between certain words: the word *draw* as a *skill* to represent and the word *design* as an *ability* to conceive. Many tutors in design modules agree that students should be encouraged to hand draw, to learn to design by hand rather than computer, but few give a strong reason for it. This paper will give a physiological reason to back-up this idea.

Drawing and designing tend to be confusing terms used with similar or the same meaning depending on context or language. For the purpose of this paper we will emphasise the strong difference between them as could be the difference, in art, between a forgery and an art piece. The difference is not in the end result but in the conception of the work. On the one hand a *skilled* draughtsman copies a master piece, on the other an *able* painter creates through innovation and thinking a masterpiece. In order to have the ability to create a masterpiece -*design*, one needs a creative mind, originality and conception. In order to *draw* it one needs a particular skill. Both can be learned but they would imply very different brain synapsis or structures of thought. Each lies within a different series of brain areas or lobes.

In the field of architecture, creating a 3D space is not as easy as one might think, it is necessary to picture it vividly and understand all its sides before one should attempt to draw it. Copying or reproducing an existing form requires drawing and good observation skills, not necessarily the ability to visualise it in one's brain. Philosopher Richard Wollheim writes that design 'requires foresight and imagination to comprehend a two-dimensional visual image as a three-dimensional inhabitable structure' (Schank Smith 2005, 1). Many other authors have debated the role of drawing and designing in architecture which we will not expand here[1] but the theory behind this research focuses on the physiological differences.

In the 1960's Dr. Sperry discovered that different sides of the brain controlled different actions in human behaviour. He started by discovering that the left side of the brain controlled speech and the right emotions. Further research brought to the theory of the left brain/right

[1] Other authors debating the subject of drawing in architectural education are: Marco Frascari, Alberto Perez-Gomez, Federica Goffi, Wolfgang Meisenheimer, etc.

brain cognitive functions (Herrmann 1989, 9). The research explains further how one side of the brain copes with the logical functions like language thus in this bracket we can find the "skills". Technical drawing or copying from photos or other 2D images are located in this side of the brain. The side of the brain that deals with emotions, is also in charge of picturing the words we read, this is creative thinking, conception of space and 3D form, etc.

Taking the argument further in the field of design teaching, research has showed that the brain is highly plastic and changes all the time. In fact in Dr Sperry's experiments he discovered that one half of the brain could learn what the other used to do (Nobelprize.org, 2014). This research has lead scientists to investigate and experiment on brain cells and synapsis concluding that the brain is a flexible organ that continually learns. The controlling factors for growth come from the outside world, experiences and practice. The brain is continually experiencing the world around us, making assessments and selecting information thus paring away what it does not need (Mallgrave 2011, 134–35) but more importantly creating new synaptic networks as required.

Within Marllgrave's research it is stated that the brain at birth has all its 100 billion brain cells, but it is the genetic information and more importantly the stimuli applied to this code of complex cells that actually creates the synaptic network that makes the brain work. Most of these neural networks will be formed by experiences and contact with the world thus extraordinarily variable between people, even identical twins (Mallgrave 2011, 135). Depending on the type of experience the brain will create a different type of synapsis and will locate it on a completely different lobe. As an example a group of scientist led by Thomas Elbert have done experiments that prove that brain cells re-organise and create new connections. The tests showed how string musicians have a marked disparity in the part of the brain that control the fingers of the left and right hands (Elbert et all, 1995). This article is important because even though a scientific study of the sort has not been carried on for draughtsmen it is clear that the hand and especially fingers create special synaptic connections that will not be the same when one follows a line that creates a sketch of a car or types commands that create a car.

Taking into account that the left side of the brain is the technical-logical part, then these lobe is only responsible for generating the 'technical drawings' –verbal/logical- of what was originally created on the right side. The understanding of space, the creativity with which to generate this space is contained within the right side of the brain: visuo-spatial (Marks 2011). These sides are constantly interacting with each other but in most cases, humans have a dominant side. The concept of dominance is well referenced in the literature on education in order to understand and focus teaching/learning skills. Most design students will have a dominant right side with mostly a visual learning ability (Lyon, 2011; Schon, 1987) but it is not until they start designing spaces that they fully understand the creative process. Many students will struggle on their first year/s to grasp this connection between the right creative side and the left technical side. Having said so, understanding how our brain works, which is our dominant side and what type of learners one is becomes the statement of this research and the leading argument in teaching design to year 1 students in architecture degrees. Individualise learner's needs to enhance and teach the skills that are weakest. A skill can always be learned with enough practice.

Finally the most important issue between them is that one can draw without the ability to design but one cannot design without the skill to draw. This is not only a discussion amongst scholars with diverse points of view/opinions but actually a physiological difference related to brain functions thus the importance to practice and encourage both, the skill and the ability. Though the introduction of a sketching assignment in the field trip of the first year students, these skill can be strengthen and weaker students get encouraged to use the pen or pencil to draw what they see. They are encouraged to not only draw buildings but also details and objects.

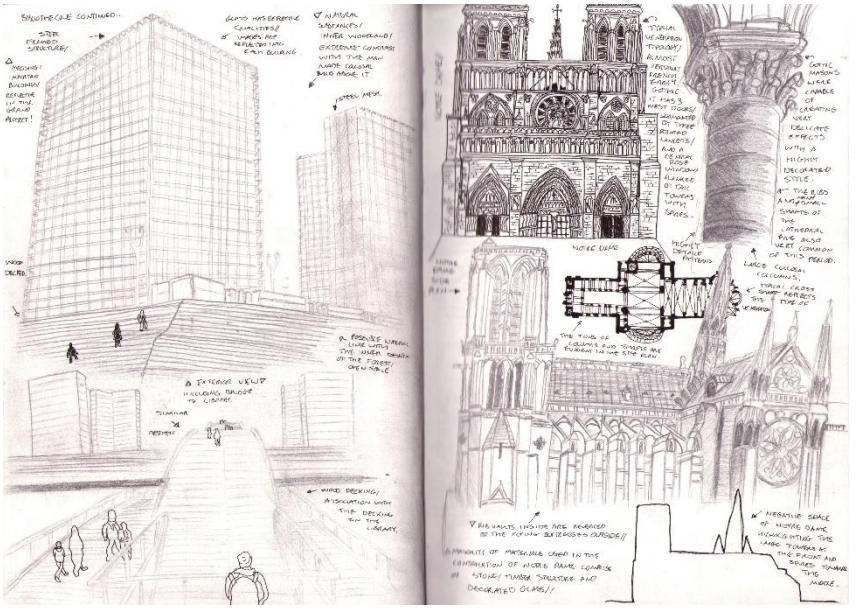

Figure 1: Hand Sketching in Paris field trip.

Source: Cooper, Fletcher; year 1 architecture student.

Chapter 2

CAD -Computer Aided Design- versus free hand drawing

As we have seen up to now the concern of this research is based on the difference between drawing and designing. One requires an image created in the brain the other the representation of that (or any) image. CAD[2], an application of computer graphics is primarily a drawing tool just like any other available. It is the evolution of the Mesopotamian reed or Roman stylus, renascence pencil or quill, the tracer and the rapidograph. Now, going back to the subject of left and right side of the brain, figure 2 shows similar instruments place on 2 different columns. On the left side, the tools required to do technical rational drawings, on the right the tools used to do creative, freehand drawings. As can be seen in the image recent technological development has come up with a way to be able to draw on a computer. This technology is saying that there are many designers that need/prefer to follow their hand movements rather than pressing commands in a keyboard.

The image produced here seeks to represent in a quick sketch the evolution of drawing. At the top we have Antique reed pens and Roman stylus, these where used all through antiquity, in medieval times the feather quill was popular and by the renascence the pencil was invented. After that I kept technical tools on the left and on the freehand tools right.

[2] In a personal note or point of view and following the definitions of this research, the name CAD should be: 'Computer Aided Drawing' and not design. An experienced designer could chose to produce a design directly on a CAD environment, but not if the overall understanding on how the 'object' of his/her design can be interpreted in a 2D format.

Figure 2: History of drawing tools.

Source: Carnevale; www.itusozluk.com, www.pencils.com, www.drumplotterar.webs.com, http://www.caratx6.blogspot.co.uk/, http://www.staedtler.com, www.graphicstabletswiki.blogspot.com, http://articulo.mercadolibre.com.uy, http://commons.wikimedia.org, www.romancoins.net

In many computer environments the word design is used to represent the drawing of the design, therefore we will use *draw* and *design* when using our own terms. Because *design* is a mental construct, it cannot be produced by a computer –or not yet! It is in the architect's brain that the *design* will take place and the computer will be in charge of representing it through *drawings.* Henceforth, if CAD is a drawing tool, just like the pencil or the pen, why would learning to use a computer programme instead of enhancing hand drawing skills be a problem in teaching design?

As explained in the previous chapter, drawing happens on the left side of the brain, design happens on the right[3]. The tools we use for one or the other are not exclusive as our chart might pre-suppose but they are more commonly used thus. An experienced designer can represent its ideas in any medium he wishes to represent it; sometimes choosing a fast tool, sometimes a very precise tool, sometimes a creative approach to impress a certain public. By this we imply that a tool for representing a design can be of any type as long as the designer knows how to communicate his/her idea. The big problem lies in the non-experienced; in the student. Some students will have arrived to their first year of university with the skills to understand volume and space and representing it on a 2D medium but most will have not. Incredible as it may seem, most students will not have fully understood three dimensional spaces and their connections. Especially transposing a 3D image into a 2D image.

The basic problem lies in the fact that conceptualising space is not as easy as it seems. Students struggle to understand the relation of an interior space and an exterior form; a staircase or a ramp; height, depth and width. They cannot visualise these spaces in their head, thus they cannot draw them or represent them. By hand the synapsis and thinking process to enable them

[3] The theory of left and right side of the brain thinking has been greatly developed since its discovery in the 1960's is a very rough statement since new developments in neuroscience have proven that the brain uses more areas than just one. Tasks normally though of happening on one side are not exclusive of that side but since the mental process or synaptic connections for creating and for drawing are completely different we will stick to these 2 terms.

to draw what it is pictured in the brain will eventually help understand that space. With computer programmes like sketch-up, students can cheat themselves into creating a volume without understanding how it has been created.

The simplest way to understand this is by asking students to design a small building with 2 floors and a surprising number will draw a staircase that, if built would look like the one in fig 5. This is not a new problem, students have been struggling with these concepts since before computers where in use. Tutors, through axonometric and perspective drawings plus the making of physical models, could help students understand space and their relationships. It was part of the syllabus in architecture schools, learning to draw through doing physical models.

Architects in practice today have changed the use of perspective draftsmen and model makers with computer skilled employees (Giddings and Horne 2001, 132). This permeates to schools which in exchange want their students to be experts in the use of computer graphics. But at what cost? As Arturo Perez-Gomez says in his essay 'questions of representation' the 'digital 'avant-garde' has degenerated into a banal mannerism, producing homogenous results with little regard for cultural context' (Frascari, Hale, and Starkey 2008, 11). Students started producing projects the computer could draw rather than the ones their creativity intended. Tutors started to realise this but at the same time computer programmes started becoming better and easier to use, having more possibilities to draw. Today, this essay is prepared to say that the wheel has spinned around and over.

Before computers where invented the art of drawing a perspective or even an axonometric was quite difficult. It required the draftsman to be able to conceptualise space in their heads – design. To create an *impossible perspective* was a task few attempted. It required great ability to understand the real but also the unreal. One clear example can be found in the drawings created by M.C. Escher.

Today simple computer programmes can create perspectives with the click of a mouse. Being able to do difficult things easily causes a big problem because students are not aware that they are creating impossible spaces/buildings. They are not aware that they have skipped a phase in their learning curve. It is like skipping the crawling stage in children's development or skipping arithmetic and pretending to understand algebra. The result can be that they think it is feasible because it stands, at least virtually, just as we can see on the images in fig. 3. After creating these images, the tutor asked if they thought something was wrong in their drawing. The general answer was 'no' at least not in the problems the tutor was clearly seeing.

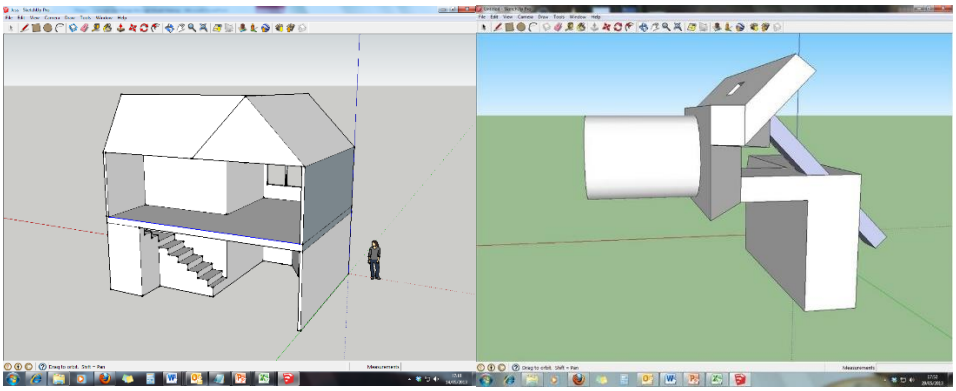

Figure 3: Sketch-up drawings copied from students work

Source: Carnevale. 2014

The problem in these simple images is clear to all of us, even to the students after a first trick question. The issue is when a student manages to create an impossible building but somehow trick the reviewer with an amazing presentation. If the student is/where asked to produce a physical model and a cross section –hand drawn, then the impossibility becomes clear.

The problem becomes even bigger when a same cohort is composed of some students that are not *designing* but only *drawing* and some students whose capability to design is already in place. On the one hand a group should be enhanced to avoid CAD and the other enhanced to use it. The real problems are the *easy-to-use* programmes that create a perspective on a stroke of a mouse. i.e. 'Sketch-up' because weak students are using it to *design* not *draw*. Even worse, students that use it to draw, benefit greatly of the speed at which they can create good 3D images of a whole area of a city.

The Studio Design course should keep the policy of hand drawing and hand work throughout its first year to avoid students going through without understanding how to *design*. The presentation of a physical model should be enhanced and followed through to the last year of their degree. Forbidding CAD altogether would be in detriment of the degree but tutors individually could address weak students emphasising the importance of physical models and hand drawings.

Conclusion

The aim of this research is to pinpoint the issues that regard the understanding of a *design* process and the skill to draw. The latter is a skill that can be taught and many books aim to teach this skill. Like riding a bicycle it needs practice, it needs failing and it needs perseverance. Learning to *design*, on the other hand, requires observation and imagination; the understanding of something that has not yet been accurately described (Moore 2003). It is difficult but not impossible, and certainly enhancing drawing skills is a step forward.

Since the difference between the two words has been stated, the logical statement is: it does not matter how we draw, it matters how or if we communicate our ideas. From this premise we gather that hand and computer drawing fulfil the same need. And yes, this paper agrees entirely. The reason for concern is not the experienced designer; it is the young year 1 student. An answer cannot be held today because a full change in teaching without drawing skills has only started, so we will only start to see results in the years to come.

Even though it needs more attention and research, this paper has provided the starting point for a discussion that should bring together the people that believe we must all change to digital and the ones holding tight to hand drawing. As it is the premise of this paper to state that digital mediums and hand skills are two sides of the same coin if one know how and when to use each. The most pressing matter in this discussion is when, as stated by Marco Frascari, clients or tutors are seduced by the beauty of a rendered image produced by a student that he/she is distracted from the true architecture/design lying behind this mask. It happens often in architecture schools to see amazing presentations but when analysing the overall design we find a decorated shed or environments that if built would not have the light conditions to produce the beautiful flowers the garden displays.

Acknowledgement

The publication of this paper and participation in Common Grounds Conference, Vancouver could not have been achieved without the strong support of the University of Derby. As a researcher and tutor within this institution I have been encouraged to progress my career in teaching. A special thank should be given to Neil Campbell and his team, Eleni Tracada, Brian Counter and Peter Scales for whom I first wrote this article and encouraged me to progress in this field.

REFERENCES

Ching, Francis D. K., and Steven P. Juroszek. 1997. *Design Drawing*. Pap/Cdr. John Wiley & Sons.

Elbert T, Pantev C, Wienbruch C, Rockstroh B, Taub E (1995). *Increased use of the left hand in string players associated with increased cortical representation of the fingers*. Science. 270, 305-307.

Frascari, Marco, Jonathan Hale, and Bradley Starkey, eds. 2008. *From Models to Drawings: Imagination and Representation in Architecture.* 1st ed. Routledge.

Giddings, Bob, and Margaret Horne. 2001. *Artists' Impressions in Architectural Design*. Taylor & Francis.

Herrmann, Ned. 1989. *The Creative Brain*. Revised. Brain Books.

King, Ross. 2008*. Brunelleschi's Dome: The Story of the Great Cathedral in Florence.* London: Vintage Books.

Lyon, Philippa. 2011. *Design Education: Learning, Teaching and Researching Through Design.* Surrey: Gower Publishing Limited.

Mallgrave, Harry Francis. 2011. *The Architect's Brain: Neuroscience, Creativity, and Architecture.* Reprint edition. Chichester, West Sussex, U.K. ; Malden, MA: Wiley-Blackwell.

Marks, Andrea. 2011. *Writing for Visual Thinkers: A Guide for Artists and Designers*. 2nd ed. New Riders.

Moore, Kathryn. 2003. *'Overlooking the Visual*'. The Journal of Architecture 8 (Spring 2003).

Schank Smith, Kendra. 2005. *Architect's Drawings: A Selection of Sketches by World Famous Architects through History.* Architectural Press.

ABOUT THE AUTHORS

Valeria Carnevale: Graduated from the Anahuac school of architecture in Mexico City and practiced as an independent architect for more than 10 years in the same country. In 2004 moved to England and completed an MA in archaeology. As an academic her career started in Mexico City as a seasonal tutor but it was not until 2005, in England when a real interest in teaching became a profession. The focus of the unit and modules taught are based on the importance of the process of design; the connecting dots between the idea and the project. As personal interests and further research she has dedicated the last years of her career to the study of Roman archaeology with a passion for Roman Glass.